

Peek under Forest Canopy with Polarimetric Coherence Tomography

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Polarimetric SAR interferometry (POLinSAR) [1] is a new branch of radar interferometry, which combines radar polarimetry and interferometry: it allows to locate scattering mechanisms as a function of height. Known applications of polarimetric interferometry are forest height estimation by Random Volume over Ground model (RVoG) inversion [2] and advanced 3D imaging techniques. New 3D techniques have been developed along with the multi baseline interferometric measurements. One of the simplest new 3D methods is Polarimetric Interferometric Tomography [3]. The method uses interferometric measurement of two or more baselines to estimate the shape of the scattering function inside the canopy. It approximates the vertical structure function of the canopy with Fourier-Legendre polynomial series. The approximation accuracy is dependent on the available amount of measurements, in this case interferometric baselines. The method utilizes also results achieved with the RVoG model for forest.

This project applies Polarimetric Coherence Tomography (PCT) to the FINSAR dataset and tries to clarify, under what conditions and how PCT can detect objects hidden under forest canopy. The airborne SAR measurement campaign FINSAR was arranged in autumn 2003 by Helsinki Technical University together with the Finnish Defense Forces and German DLR arranged. Among other experiments, an L-band multi-baseline fully polarimetric SAR image set was measured. The ground arrangements included three corner reflector assortments hidden in various types of forests. This part of the campaign was called FINSAR. This study attempts to reveal these corner reflectors by means of PCT.

Our study shows that, under certain conditions, objects under forest canopy are visible on the L-band interferometric tomograms. It has to be noted that in most cases when corner reflector could be certainly identified in a tomogram, the corner reflector was also visible in SAR amplitude and coherence images. However, this may not be the case when more baselines are used. At the moment there are some theoretical restrictions for the multi-baseline method and many practical shortages of the FINSAR dataset and, therefore, this claim could not be proved.

References

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